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High Resolution X-ray Diffraction of Kaolinite Clay Reacted at High pH and Ionic Strength

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Beamline(s): X18A

The weathering behavior of poorly crystallized kaolinite (KGa-2) has been studied under extreme geochemical conditions (0.05 M Al_T, 2M Na^+, 1M NO_3^-, pH~14). Experiments were conducted for periods ranging from 1 to 190 days, with initial Cs^+/Sr^{2+} concentrations of 10^{-5}, 10^{-4} and 10^{-3} M. For a better understanding of secondary Si phases, acid ammonium oxalate (0.2 M, pH=3) extractions were performed on reacted samples. After 33 days of reaction time, secondary mineral phases (i.e., zeolites) were observed by X-ray diffraction (XRD), scanning electron microscopy/energy dispersive X-ray spectroscopy (SEM/EDS) and diffuse reflectance infrared Fourier transform (DRIFT) spectroscopy at the lowest Cs^+/Sr^{2+} loading. Formation of secondary phases is strongly controlled by initial Cs^+/Sr^{2+} concentration. Zeolites formed in this system are strontium aluminum silicate hydrate (chabazite), sodium aluminum silicate hydrate (sodalite) and sodium aluminum nitrate silicate hydrate (cancrinite). Sr-containing chabazite and sodium aluminum silicate are the predominant secondary phases at high and low Cs^+/Sr^{2+} loadings. To further understand the structure and characteristics of newly formed zeolites, we performed the HRXRD using the X18A beamline at NSLS. Current work includes using the GSAS program to determine cell parameters, the extent of Sr substitution, atomic position and to quantify each of zeolite in the reacted kaolinite systems.

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